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(10) Bruce E. Armstrong

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AVIONICS DATA FOR COST ESTIMATING

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I. INTRODUCTION

Avionics cost has been a continuing problem to the defense cost analyst. The various services and the Office of the Secretary of Defense (OSD) have sponsored numerous avionics data collection efforts, as well as funding various companies to develop cost models and cost estimating relationships. To mention a few, both the Air Force and the Navy, and research firms such as General Research Corporation (GRC), Research Management Corporation (RMC), and Institute for Defense Analyses (IDA), have all been involved at one time or another with efforts to develop the avionics cost estimation methods and a supporting data bank. The reason for this level of effort is that the costs of avionics account for nearly 30 percent of the total costs of fighter aircraft and a significant amount in most other aircraft types. Yet, because of rapid technological change, typically small production runs, and poor historical cost information, reliable prediction of avionics costs has been impeded.

and

This paper discusses a recent Rand study sponsored by OSD/Director of Planning and Evaluation (DP&E) which had the objective of creating an avionics data base for tactical aircraft.[**] It describes the data base using examples from the report, as well as discussing some of the classical avionics cost analysis problems which were encountered.

Prerequisite to further discussion is a definition of avionics. We have a working definition which is to include airborne electronics equipment having the work unit codes between 61000 and 76000. This definition includes equipment such as communications, navigation (radio, radar and bombing), fire control, and ECM. We did not include

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[*] This paper was presented at the 1976 DOD Cost Analysis Symposium held in Airlie, Virginia on November 14-17, 1976.

[**] In addition to the author, Joseph Large and Patricia CoNine were major contributors to the Rand study. However, the views expressed in this paper are solely those of the author.

flight control equipment or some of the simpler instruments because we were interested mainly in high cost electronics equipment.

Our sample for the data collection effort included equipment on board tactical combat aircraft developed since 1965. This time frame was selected because we were seeking equipment of a relatively modern technology and because we did not want to repeat data which had already been collected from the studies previously mentioned. The aircraft in the sample included the following:

* F-111A/C/D/E/F
* FB-111A
* F-4C/D/E/J
* F-5E
* A-6E
* A-7D/E
* F-14A
* F-15A
* F-16

The remainder of this paper describes the data base that we collected and includes some observations about using the data for analysis.

Because much of the information collected from avionics manufacturers is proprietary, the examples presented in this document have been altered to omit the AN descriptor, the unit cost or some other data which might violate our agreement with the manufacturers to protect such information.

II. THE DATA BASE

One of our objectives was to show the cost of the avionics suites* for all the aircraft in the sample. We did this in two ways: On an aggregate basis, using budgetary data for the avionics portion of aircraft flyaway costs, and by building up to the total avionics suite cost through identification of individual equipment cost. First, let us examine the budgetary data collected.

While cost analysts would prefer to work with expenditure data, very little expenditure data are available from government sources. Table 1 shows budgetary data for each aircraft, by year. The table presents the total avionics suite costs and the production quantities in the respective years.

During the preparation of this table, we discovered a few problems. First, in many government documents it is not always clear whether both government-furnished equipment (GFE) and customer-furnished equipment (CFE) are included in the figures. For example, the F-4D shown in this table does not include the CFE portion and that omission was not noted in the budget documents. Second, we found that avionics suites change over time. They change because of technological improvements and/or because of changes in mission requirements. An example of this can be seen with the A-4M where costs increase from 1971 ($72.1 thousand) to 1974 ($371.4 thousand). This $300 thousand increase in avionics is the result of additional equipment, increased capability of original equipment, and inflation.

Because we are dealing with budgetary data, we wanted to cross check this information against other types of aggregate information. A second method was used to look at the cost of aircraft avionics suites. This method involved identifying each piece of equipment on board a specific aircraft and collecting the cost for those pieces of equipment. We did use this information to cross check the budgetary data. Table 1 shows that the F-4J costs are at about $800,000 for the

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*An avionics suite is defined as the total complement of avionics systems equipped on a given aircraft.

Table 1

ELECTRONICS COST PER AIRCRAFT BY FISCAL YEAR

(In Thousands of Then-Year Dollars)

Aircraft	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	19[illegible]	[illegible]
Navy														
A-4M							64.4	72.1			371.4[b]			
(Qty)							(4[illegible])	(24)			(44)			
A-6E							1566.2	1563.1	1671.4	1366.0	1385.3	1720.7		
(Qty)							(12)	(12)	(12)	(21)	(13)	(12)		
A-7E				253.0	212.3	211.8	311.0	371.0	443.1	639.3	912.5	646.2		
(Qty)				(7)	(150)	(160)	(27)	(30)	(26)	(48)	(30)	(30)		
F-4J			753.7	879.3		777.7	781.4							
(Qty)			(152)	(250)		(68)	(34)							
F-14A								4200.4	3355.4	2739.0	3009.0	2536.7		
(Qty)								(26)	(48)	(48)	(50)	(50)		
Air Force														
FB-111A				2585.0	2148.0	1810.0								
(Qty)				(3)	(6)	(68)								
F-111A		4201.0	2511.0	1992.0	1997.0									
(Qty)	(1)	(6)	(10)	(75)	(65)									
F-111C					1803.0									
(Qty)					(24)									
F-111D								1719.0	1643.0	2579.0				
(Qty)								(7)	(73)	(16)				
F-111E						3345.0	2236.0	1719.0						
(Qty)						(31)	(53)	(10)						
F-111F							1778.0	2167.0						
(Qty)														
F-5E									48.0	49.0	59.0	68.0		
(Qty)									(21)	(166)	(214)	(71)		
A-7D				420.0	409.0	412.0	440.0	443.0	480.0	610.0	666.0			
(Qty)				(5)	(12)	(57)	(123)	(88)	(97)	(24)	(24)			
A-10A												360.0	32[illegible]	
(Qty)												(26)	(6[illegible])	
RF-4C					536.0	639.0		708.0	742.0	783.0				
(Qty)					(64)	(36)		(12)	(12)	(12)				
F-4D[c]	378.0	294.0	315.0											
(Qty)	(52)	(222)	(519)											
F-4E				259.0	446.0	603.0		769.0	726.0	767.0				
(Qty)				(290)	(245)	(145)		(24)	(24)	(24)				
F-15A										2203.0	1490.0	1586.0	2689.0	
(Qty)										(30)	(62)	(72)	(90)	
F-16														1325.0
B-1														4000.0
(Qty)														(3)

SOURCES: Naval Air Systems Command letter AIR-50633/TJG; USAF/ASD Budget Form 1537.

[a]Budget.

[b]Cost increased because of modification to solid-state electronics, expansion of capabilities, and break in production.

[c]Apparently GFE only.

avionics. In Table 2, which is the F-4J individual avionics components, the total cost is $1 million in 1975 dollars. This seems reasonable, taking inflation into consideration. In most cases, the budgetary figures were reasonably close to the figures derived from the buildup approach.

Let us turn our attention now to Table 2, the individual aircraft avionics cost sheets. In our data base, we have a sheet such as this example for all combat aircraft in our sample. These data sheets are very useful in situations where cost analysis of total aircraft avionics is being performed.

Initially, we encountered a subtle problem in the development of these data sheets. There were many anomalies in the "AN designators." The anomalies occur in three ways. First, there is equipment included in the Work Unit Codes 61000 to 76000 which is not avionics. Included were electro-mechanical devices such as chaff dispensers and weapon release systems. We were careful to identify and perhaps eliminate, for analytic purposes, these types of systems. Second, there were instances where equipments with the same alpha designator, say APN, were functionally different. Third, we had occasions where equipments which were functionally identical had different alpha designators. For instance, radar sets have several alpha designators including APN, APQ, ASN, APA, and APG.

Notice the number and variety of sources that we had to investigate in order to compile the total avionics cost for just one aircraft type. Sources for information in the example include avionics manufacturers, DOD agencies, airframe prime contractors, and other research organizations. We relied heavily on the information supplied by avionics manufacturers, as they are able to provide feedback and qualitative insights not afforded by most other sources. Specifically, the manufacturers discussed probable cost drivers, apparent data inconsistencies, future technological changes, and system characteristics.

Because there is not a central repository within the DOD for avionics costs, we were forced to contact and visit various System Program Offices, cost analysis organizations, and cost libraries (frequently only to uncover fragments of a study which had preceded us).

Table 2

F-4J[a]

Function	Description	AN Designator	Year	Then-year $ Cost	1975 $ Cost	Source
VHF communications	Radio	ARR-69	1970	Proprietary[b]	Proprietary[b]	NAVAIR
	Dig Data Com	ASW-25	1969			RMC
IFF	Interrogator	APX-76	1973			RMC
Radio nav	Integ Elect Central	ASQ-19	1973			USAF/CAEL
	TACAN	ARN-86	1967			GAOR
	ADF	ARA-50	1967			NAVAIR
	Receiving/Dec	ARA-63	1974			NAVAIR
Radar nav	Elect Altimeter	APN-194	1975			Honeywell
	Elect Altimeter	APN-141	1970			NAVAIR
	Beacon	APN-154	1974			GAOR
Bomb nav	Computer	AJB-7	1969			Lear
	Nav Computer	ASN-39	1969			RMC
Fire control	Missile Control	AWG-10	1970			Westinghouse
	Fuze Control	AWM-1	--			
	Target Acquisition	AVG-8	1975			Honeywell
ECM	ECM Recvr	ALR-45	1973			NAVAIR
	Radar Set	APR-27	1970			NAVAIR
	Radar Recvr	ALR-50	1973			NAVAIR
	Chaff Disp	ALE-29	1970			RMC
	Radar Recvr	APR-25	1969			RMC
	ECM Set	ALQ-100	1971			Sander's
	ECM Set	ALQ-91	1969			RMC
	ECM Set	ALQ-126	1975			Sander's
				$823.2	$1001.3	

[a]Equipment Listing from work Unit Code Manual dated July 1975.

[b]Proprietary information (individual unit costs are included in data base).

Note that one DOD source shown on this sheet is USAF/CAEL. This is the cost data collected by the Air Force agency which procures spares. There are some cautions which we took in using this data. First of all, in many instances systems procured for spares are not procured at the system level, but rather by individual Line Replaceable Units (LRUs). They are typically procured in odd LRU numbers such that it is very difficult to determine an equivalent system price. This is compounded by the fact that spares typically cost 15-25 percent more than production avionics because of small lot cost penalties and amortized start-up costs. The potential difficulties and ambiguities of spares cost information were recognized, and only data for total system costs have been included in our data base.

Even turning to all these sources for information, occasionally we were still unable to get cost data. The AWW-1 on the F-4J is an example where we were unable to collect information. We still show this system on the table so that the cost analyst will be aware that system is a part of the avionics suite.

AVIONICS SYSTEM DATA SHEETS

Our main objective in the avionics study was to collect individual cost and technical data for each avionics system. Table 3 presents an example of an equipment "cost data sheet. The cost information displayed represents cost to the government. Because of competitive sensitivities, manufacturers were not at all willing to disclose, or even discuss, the actual production cost characteristics. These sheets contain information on production year, nonrecurring costs, quantities, unit costs, and miscellaneous relevant notes.

Where we had more than one source for the cost data, we frequently found that the information was inconsistent. In this example, neither the quantities produced in a given year nor the unit costs, except in 1974, are in agreement. Typically, this required us to follow up with the manufacturers, ask questions about the source of the data, and seek explanations for the differences. Where source differences were irreconcilable, we typically used the manufacturer's data for analytic purposes.

Table 3

EXAMPLE--UNIT COST DATA SHEET

DESIGNATION: Proprietary

EQUIPMENT DESCRIPTION: Navigation Radar

MANUFACTURER:

AIRCRAFT		YEAR	QUANTITY	UNIT COST
A-7	(1)	1967	12	42.7
		1968	172	19.7
		1969	217	19.7
		1970	212	20.3
		1971	127	27.3
		1972	24	32.2
		1974	42	37.6
	(2)	1967	233	19.8
		1970	317	24.2
		1971	119	32.6
		1971	121	34.6
		1973	24	37.3
		1974	42	37.6

NON-RECURRING COST: $2,340.(3) **YEAR DOLLARS:** 1970

SOURCE: NAVAIR (1), Mfgr (2), IDA (3)

Costs are in thousands of dollars.

NOTES: The set is a doppler radar that provides continuous measurement and indication of aircraft ground speed and drift angle. It provides ground speed indications of 100 to 999 knots and drift angle indications of 0 to ± 30 degrees on the control indicator at altitudes between 40 ft and 50,000 ft. Ground speed, drift angle, and operational status information are converted to digital format before being routed to the navigation/weapon delivery computer.

At this point, a few remarks are in order about the relationships between products from a single manufacturer. Figure 1 shows two hypothetical family learning curves labelled A and B. Empirically, we

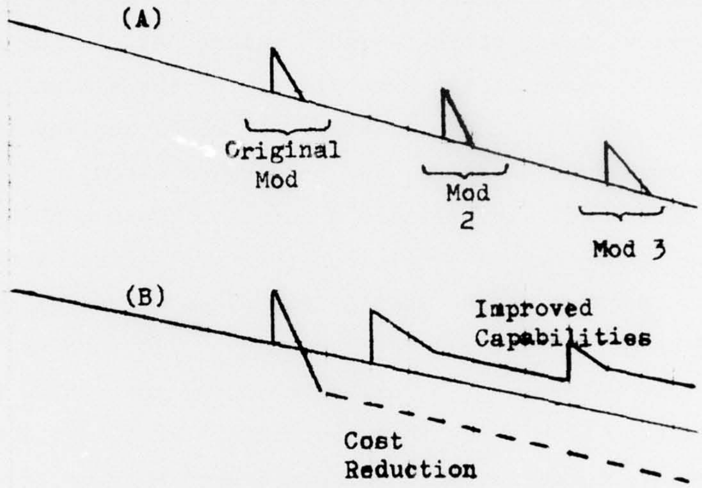

FIGURE I. AVIONICS FAMILIES

found that modifications and follow-on equipment produced by one manufacturer (where the function was the same) did not return to a first unit cost. Instead, we observed a temporary increase in cost or price from the previous system; then very rapid improvements, eventually returning to the original learning curve (curve A). Recognition of the product line cost characteristics is important in that "follow-on" and "modifications" in many instances cannot be treated as individual sample points. Product lines may exist even though a system has a unique "AN designation." If the avionics family is discovered, most likely the units will not have unique learning curve characteristics. Another example of this is shown on curve B. A modification is made to a system either to improve its capabilities, as shown by the line which stays above the original learning curve, or to make a cost reduction improvement, as shown by the dotted line

which goes below the original learning curve.

Table 4 presents an example of a unit technical data sheet. Our data was collected from the Electro-magnetic Compatibility Analysis Center (ECAC), from manufacturers, and from the Department of Defense. (Once again, we faced the problem of conflicting data, particularly in the description of physical characteristics.) Entered on this sheet are the physical descriptors (weight, volume, etc.), the electrical characteristics, some of the capabilities of the system, and the technology level. We rather arbitrarily defined technology into three categories--tubes, transitors, and integrated circuits (IC). We recognize that there are probably a number of more sophisticated methods of defining technological level, but this was a first attempt to stratify our sample. Because of the sample time frame we are examining, we expected and observed that most of our sample fell into the transistors or solid state category. We further observed that while there was a rapid transition from tubes to transistors, the transition from transistors to integrated circuits has moved much more gradually. There is not a sweeping conversion to integrated circuits, but rather a steady increase in the proportion of ICs.

Table 5 is another example of a technical data sheet that shows the characteristics of a computer. We have actually developed three data sheet formats, one as we previously presented in Table 4, another specifically for computers, and a third for inertial navigation systems. The sheets are tailored to collect the information that appears to be most relevant in analyzing cost for these systems. For example, on the computer sheet we have added the characteristics of memory size, number of instructions, and access time.

A few interesting displays of the information were then determined and displayed on a summary sheet (example in Table 6). For each system, we normalized the costs to 1975 dollars, plotted a cost-quantity curve, ran a regression, and determined the 100th unit price. The summary sheet also shows physical characteristics, power input, and technology level. The technology level shown relates to the technical data sheets where a (1) denotes tubes, (2) denotes transistors, and (3) denotes integrated circuits.

Table 4

EXAMPLE--UNIT TECHNICAL DATA SHEET

DESIGNATION:	Proprietary
EQUIPMENT NAME:	Navigation Set
AIRCRAFT:	A-7
WEIGHT:	65 lbs
VOLUME:	3.17 cu.ft.
DENSITY:	20.5 lb/cu.ft.
INPUT POWER:	
FREQUENCY BAND:	13,275-13,375 MHz
OUTPUT TUBE:	Magnetron
FREQUENCY RANGE:	13,275-13,375 MHz
MAXIMUM POWER OUTPUT:	0.016 kW
EMISSION BANDWIDTH:	216.19894 KHz
PULSE WIDTH:	4.167 to 6.25 μsec
PULSE REPETITION FREQUENCY:	80,000 to 120,000 pps
RECEIVER TYPE:	Superheterodyne
FREQUENCY RANGE:	13,275-13,375 MHz
RF BANDWIDTH:	260 KHz
SENSITIVITY:	-97 dBm
NOISE FIGURE:	
ANTENNA TYPE:	Slotted array
GAIN:	18 dB
BEAMWIDTH:	30°H x 4.1°V
DESCRIPTION:	Fan
NO. OF MAIN BEAMS:	1
SLEW ANGLES:	Fixed

TECHNOLOGY: TUBES ☐ TRANSISTORS ☑ INTEGRATED CIRCUITS ☐

Ground speed indicator
Drift angle measurement

Pulse Doppler

Table 5

AIRBORNE DIGITAL COMPUTER

Designation	Proprietary
Equipment Name	
Aircraft	A-7
Characteristics	
Weight	80 lbs
Volume	1.5 cu ft
Density	53.3 lb/cu ft
Power Consumption	325 watts
Memory Size	16 K words
Word Length	16 bits
Number of Instructions	51
Memory Access Time	~1 μsec
Cycle Time, Read/Write	2.5 μsec
Throughput	125 K ops
Computation Time	
Add	5 μsec
Multiply	20 μsec
Divide	21 μsec

Table 6

EXAMPLE--EQUIPMENT SUMMARY SHEET

AN	Description	100th Unit Price 1975 ($000)	Cost/lb ($000)	Weight	Volume (cu in)	Density	Power Input	Technology Level	Learning Curve
Proprietary		97.9	.38	233	--	--	3,000	1	.615
	Radar Set	34.3	.39	90	6,394	.0141	400	1	.716
	Radar Set	868.2	1.52	573	15,811	.0362	11,696	3	.914
	Doppler Radar	111.6	1.32	84	12,400	.0068	749	2	.855
	Elect Altimeter	11.7	.78	15	276	.0543	--	2	.835
	Doppler Radar	21.4	.40	53	3,525	.0150	425	2	.743
	Beacon Set	4.8	.80	6	190	.0316	--	2	.857
	Elect Altimeter	6.1	.32	19	691	.0275	80	2	--
	Elect Altimeter	17.6	.63	28	1,849	.0151	90	2	.922
	Radar Set	29.8	.46	65	5,218	.0125	325	2	.901
	Radar Set	128.2	3.00	42	2,782	.0151	175	3	--
	Radar Set	28.1	.43	65	5,478	.0119	--	2	--
	Elect Altimeter	3.9	.56	7	--	--	--	--	.981
	Radar Set	68.3	1.55	44	3,456	.0127	120	2	--
	Radar Set	205.1	.34	604	19,000	.0318	--	1	.770
	Radar Set	99.7	--	--	--	--	--	--	.864
	Radar Set	249.5	.47	532	21,600	.0246	--	--	.826
	Radar Set	81.6	.39	211	18,144	.0116	--	--	.944
	Radar Set	126.7	.15	856	26,611	.0322	3,600	1	--
	Radar Set	103.1	.12	866	27,302	.0317	3,600	1	--
	TF Radar	128.1^{c}	.54	237	8,985	.0264	2,000	2	--
	Attack Radar	287.2^{c}	.78	370	10,714	.0345	1,637	2	1.180
	Attack Radar	174.8	.47	370	10,610	.0349	1,637	2	.750
	Radar Set	56.7	.30	187	10,022	.0187	--	--	.947
	Radar Set	277.3	.42	667	21,802	.0306	3,410	2	.883
	FL Radar	114.0^{d}	.49	200	20,736	.0111	2,200	2	--
	TF Radar	124.5	.53	207	8,986	.0264	2,000	2	.946
	Attack Radar	--	--	512	12,096	.0423	--	2+	.900
	TF Radar	131.6	.56	237	8,986	.0264	2,000	2	.945
	Attack Radar	263.9^{d}	.71	370	10,610	.0349	1,637	2	--
	[illegible]ar Set	--	--	5	--	--	--	--	--
	R[illegible]r Set	41.3	.38	0	5,875	.0[illegible]7	800	2	.892

Typically it is assumed, in defense cost analysis, that avionics experience approximately a 90 percent learning curve. This small sample shows the potential dangers of assuming such a slope. The range of slopes is from 61.5 percent to 118 percent. In plotting the cost quantity curves, we also observed a phenomenon best described as "recouping investment." In several cases, we observed production costs or price which seemed to be proceeding down a typical 90 percent curve for the first 1 or 2 production lots. But then in about the third lot or in the third or fourth year of production, the cost would suddenly jump higher, then again proceed down the same percentage curve. We are not sure what this means, but it may indicate that manufacturers are buying in or submitting optimistic predictions of production costs at the early proposal stage and then recouping in subsequent production lots if the original predictions were erroneous.

One of the columns in the summary sheet depicted in Table 6 is that of cost per pound. A quick scan of this column reveals the danger of arbitrarily using cost per pound as an estimating factor. For example, within an apparently homogeneous sample of radar sets, the cost per pound ranges from $120 to $3000. We found this kind of variability to exist within many classes of avionics.

III. THE APPLICATION AND VALUE OF AVIONICS COST DATA

We did some cursory analysis of this data base which we would like to relate, using a segment from our avionics sample.

THE SAMPLE

The example is Bombing Navigation. Table 7 shows a list of bombing navigation equipment on board aircraft developed since 1965. The sample size is 46.

Table 7

BOMBING NAVIGATION EQUIPMENT

AJB-3A	APQ-88	APQ-130	ASN-46	ASN-90
AJB-7	-99	-134	-48	-91
AJN-16	-109	-144	-50	-92
AJQ-20	-110	-153	-56	-99
APN-167	-113	ASN-19	-67	-109
-185	-114	-31	-70	ASQ-61
-189	-126	-39	-69	-91
-190	-128	-41	AVQ-7	-119
ASQ-133	ASQ-155	AVA-9	-9	AYN-4

SAMPLE ANALYSIS

The sample size was significantly diminished due to a number of problems. First, we were unable to collect cost or technical information on five of the Bombing Nav systems for a variety of reasons. This 90 percent response rate is probably unusually high. Second, we discovered, subsequent to the data collection, that nine of these bombing navigation systems were misclassified. That is, they were not really bombing navigation systems by definition. They were, for example, displays and altimeters which had to be eliminated from the data analysis. Third, there were some product line relations, follow-ons or modifications, within our sample. We found five families of equipment which further reduced our sample by 11. Our sample size was reduced to 21.

STRATIFICATION

In an effort to create homogeneous samples of equipment we stratified the bombing navigation equipment by technology and function. We divided technology by tube, solid state, and integrated circuits (Table 8). As expected, most of the sample points fell in the solid state category. We also identified some logical equipment categories--doppler radar, inertial navigation, ballistic computers, attack radars, and terrain following radars. We recognized that this matrix can be expanded to a 3 or 4 dimensional matrix by further subdividing by capability, modes, or some other unique equipment characteristics.

As shown in Table 8, most sample cells contain only one or two avionics systems. The important message here is that in striving to develop homogeneous sample categories from which meaningful statistical analysis can be done, the sample size is reduced to the point where statistical analysis would not be meaningful.

APPLICATIONS OF THE DATA

Statistical analysis of the data is apparently pointless and, as a result, the precision of any derived cost estimating models would be suspect. There are still a number of useful applications of the Rand avionics data base.

A great deal of avionics cost analysis is done by analogy, that is, seeking out a past system that has similar physical, performance and, hopefully, cost characteristics as a system being proposed. For this type of analysis, a data base such as ours, that includes nearly 200 avionics systems, is ideal.

Another application of our data base lies in the usefulness of the aggregate avionics suite costs collected. There may be some relationship, for example, between the cost of the avionics suite and mission requirements or some other aircraft mission requirement variable.

This does not rule out statistical analysis of avionics cost data. There are very definite limitations using our data base, but perhaps through the expansion of the aircraft samples to include, say, transport aircraft, electronics aircraft, command post aircraft, anti-submarine aircraft, and so on, the sample cells of homogeneous equipment could be expanded to the point where some significant analysis could be performed.

Table 8

MATRIX STRATIFICATION

Technology	Type of Navigation				
	Doppler	Inertial	Ballistics	Attack	TFR
Tube		ASN-31 ASN-48/56	AJB3A/7		APQ-109
Solid state	APN-185/190	AJQ-20 ASN-90	ASQ-61 ASQ-91 ASQ-133/AYK-6	APQ-113/114/144 APQ-99 ASN-39 ASN-91 ASN-41 ASN-46	APQ-88/110/128/134 APQ-116/126
Advanced/integ. solid state		ASN-109 AJN-16			

IV. FUTURE REQUIREMENTS

Our experience in avionics cost analysis leads us to conclude that there are potentially better ways for the Department of Defense to proceed to insure a useful avionics cost data base. Foremost is continuity. The intermittent nature of previous cost analyses and data base preparations have limited the value of the data collected. Each new research company must collect cost and technical data which has already been collected by other research firms.

In order to capture the cost evolution of avionics equipment and eliminate the inefficiency of continuous recollection of information, the Department of Defense needs to assign specific responsibility to a collecting and processing organization and to continually support that organization. Additionally, DOD needs to utilize the systems which are available for data storage and retrieval, namely the Cost Analysis Data Bank System (CADBS) with Battelle Laboratories.

With many of the services and contractors converting to the RCA cost estimating model, PRICE, there is a need for DOD to maintain an independent estimating capability. One way to accomplish independence is through continuous collection and analysis of avionics information.